A highly bioactive Poly (amido amine) /70S30C Bioactive Glass hybrid with Photoluminescent and Antimicrobial properties for bone regeneration

Fakhraddin Akbari Dourbash [a]; Parvin Alizadeh [a*]; Shahram Nazari [b]; Alireza Farasat [c]

[a] Department of Materials Science & Engineering, Faculty of Engineering & Technology, Tarbiat Modares University, P. O. Box: 14115-143, Tehran, Iran

[b] Department of Environmental Health Engineering, School of Public Health, Member of Student Research Committee, Iran University of Medical Sciences, Tehran, Iran.

[c] Young Researchers & Elite Club, Pharmaceutical Sciences Branch, Islamic Azad University, Tehran, Iran

*Corresponding Author: Professor Parvin Alizadeh,

Corresponding Author's Institution: Tarbiat Modares University

Corresponding Author's Email:P-Alizadeh@modares.ac.ir

Corresponding Author's phone: +98 21 82884399

Abstract

The field of tissue engineering constantly calls for novel biomaterials that possess intrinsically multifunctional properties such as bioactivity, bioimaging ability and antibacterial properties. In this paper, Poly (amido amine) generation 5/bioactive glass inorganic-organic hybrids have been developed through direct hybridization by 3-glycidoxypropyltrimethoxysilane (GPTMS) as coupling agent. Results indicated that the degree of covalent coupling by GPTMS and the weight percent of inorganic and organic constituents highly influence hybrids properties. It was found that nanoscale integration of inorganic and organic chains by GPTMS significantly endows hybrids with high thermal stability. Furthermore, hybrids exhibited photoluminescent ability (emission 400-600 nm and 700 nm) without incorporating of any organic dyes or quantum dots. In addition, hydrophilicity of our hybrids indicated good cell/material interaction. The biological apatite was formed on the surface of calcium containing hybrids when soaked in simulated body fluid (SBF) for 1 week. Hybrids also showed linear biodegradation behavior in SBF that could be controlled by the degree of covalent crosslinking which was indicative of their stable biodegradation ability. High inherent antibacterial properties against *Staphylococcus aureus* was also observed from poly (amido amine)/silica hybrids. No adverse cytotoxicity for human gingival fibroblast cell lines (HGF) was detected after 4 days. It is envisaged that our novel multifunctional hybrid system will confer intriguing potential in advancing the field of tissue engineering.